PATENT CLAIMS

1. A method for optimizing power plant control values, where the method comprises the steps of

   a) determining a trajectory of plant control values $\vec{u}(\tau)$,

   b) determining from the trajectory of plant control values $\vec{u}(\tau)$, by simulation of the power plant's behavior, corresponding trajectories of costs $\vec{c}(\tau)$ for operating the plant and trajectories of revenues $\vec{q}(\tau)$ from selling produced output,

   c) computing a total operating cost $J[u]$ as an integral of an objective function that comprises a difference between costs $\vec{c}(\tau)$ and revenues $\vec{q}(\tau)$,

   d) iteratively repeating steps a) through c) with the optimization module varying the trajectory of plant control values $\vec{u}(\tau)$ until an optimized lower total operating cost $J[u]$ is arrived at,

   characterized in that in step b), by modeling of plant components, a trajectory representing a rate of ageing $\vec{e}(\tau)$ of plant components is determined from the trajectory of plant control values $\vec{u}(\tau)$, and that, in step c), the objective function comprises said rate of ageing $\vec{e}(\tau)$.

2. Method according to claim 1, characterized in that, in step b) trajectories of plant output values $\vec{p}(\tau)$ are determined, and that, in step c) the objective function comprises a difference between plant output values $\vec{p}(\tau)$ and associated demand values $\vec{d}(\tau)$.

3. Method according to claim 1, characterized in that the total operating cost $J[u]$ is computed as

$$J[u] = \int_{t}^{t+T} R_1 \vec{e}(\tau) + R_3 \left[\vec{c}(\tau) - \vec{q}(\tau)\right] \; d\tau ,$$

   where R_1, R_3 are weighting matrices, t is a present time and T is a predetermined duration.

4. Method according to claim 2, characterized in that the total operating cost $J[u]$ is computed as

$$J[u]=\int_{t}^{t+T} R_1\,\vec{e}(\tau)+R_2\left[\vec{d}(\tau)-\vec{p}(\tau)\right]^2+R_3\left[\vec{c}(\tau)-\vec{q}(\tau)\right]\quad d\tau\,,$$

where R_1, R_2, R_3 are weighting matrices, t is a present time and T is a predetermined duration.

5. Method according to claim 1, characterized in that at least part of the trajectory of plant control values $\vec{u}(\tau)$ corresponding to the optimized lower total operating cost $J[u]$ is displayed to an operator.

6. Method according to claim 1, characterized in that at least part of the trajectory of plant control values $\vec{u}(\tau)$ corresponding to the optimized lower total operating cost $J[u]$ is used to control the actual plant 3.

7. A computer program product comprising a computer readable medium, having thereon: computer program code means to make, when said program is loaded in a computer that is operationally connected to a power plant, the computer execute the method according to one of claims 1 to 6.

8. A power plant optimizing system that optimizes plant control values and comprises

   a) an optimization module (1) that is configured to determine a plurality of trajectories of plant control values $\vec{u}(\tau)$ and to determine a total operating cost $J[u]$ as an integral of an objective function that comprises a difference between costs $\vec{c}(\tau)$ and revenues $\vec{q}(\tau)$ that are associated with operating the power plant according to the plant control values $\vec{u}(\tau)$,

   b) a simulation module (2) that is configured to determine, from the

trajectory of plant control values $\vec{u}(\tau)$, by simulation of the power plant's behavior, corresponding trajectories of costs $\vec{c}(\tau)$ for operating the plant and trajectories of revenues $\vec{q}(\tau)$ from selling produced output,

characterized in that the simulation module (2) is configured to determine, from the trajectory of plant control values $\vec{u}(\tau)$, a trajectory representing a rate of ageing $\vec{e}(\tau)$ of plant components, and that the objective function comprises said rate of ageing $\vec{e}(\tau)$.

9. A power plant optimizing system according to claim 8, characterized in that the simulation module (2) is configured to determine, from the trajectory of plant control values $\vec{u}(\tau)$, plant output values $\vec{p}(\tau)$, and that the objective function comprises a difference between plant output values $\vec{p}(\tau)$ and associated demand values $\vec{d}(\tau)$.

ABSTRACT

In a method and computer program product for optimizing power plant control values and a power plant optimizing system an optimization module (1) minimizes total plant operation costs while achieving predetermined required output values for produced power and process steam. This is done by, at a given time, determining future values of control values and simulating, in a simulation module (2), the behavior of the plant up to a given future time. Corresponding fuel costs and generated power are determined in the simulation, and incorporated in an objective function. The optimization module (1) minimizes the objective function by varying the control values. According to the invention, a rate of ageing of plant components is determined when simulating the future behavior of the plant, and the objective function to be minimized comprises said rate of ageing.

(figure 1)